DATA TECHNOLOGY CORPORATION

instruction manual
344 4 digit/systems meter

DATA TECHNOLOGY CORPORATION
1050 EAST MEADOW CIRCLE • PALO ALTO, CA. 94303

instruction manual
344 4 digit/systems meter

PART NO. 18915-10

MANUAL CHANGE SHEET
MODEL 344

A recent design change has been incorporated into the Model 344. The design change provides improved input current stability, an active input filter, and reduced power requirements. The change consists of a complete re-design of the Analog I Board. The revised calibration procedures and the revised Analog I Assembly Drawing are included below.

SELECTION OF RESISTOR R153

The following procedure is part of the initial factory adjustment and should not have to be performed. However, the procedure can be used as a check of performance.

Step 1:

Carefully check the Analog I Board in the instrument against the Analog I Assembly Drawing below. If the Assembly Drawing and the instrument match, check that resistor R12 in the Motherboard (#18250) has been removed. If it has not, remove the resistor.

CAUTION

If the Assembly Drawing below and the instrument do not match, DO NOT REMOVE RESISTOR R12. Serious damage to the instrument can result. Check the Assembly Drawing on page 16 and if it matches the instrument, use the calibration procedure on page 18.

Step 2:

Short the base of Q1A on the Analog I Board to analog ground (short across capacitor C17) and measure the voltage from the base of Q1B (junction of R43 and C40) to analog ground. If the voltage is 300 microvolts or less, either positive or negative, skip step 3 and continue with step 4. If the voltage is greater than 300 microvolts, perform step 3.

Step 3:

Remove resistor R153 from the Analog I Board and remeasure the voltage at the base of Q1B with the base of Q1A still shorted. Select a resistor in accordance with Table 1 and install in place of R153. Remeasure the voltage at the base of Q1B, it should now be less than 300 microvolts (again, it can be either polarity).

Step 4:

With the base of Q1A still shorted, adjust the front panel zero control R59 for a plus and minus indication (i.e., the transition between plus and minus).

Step 5:

Remove the short at the base of Q1A and connect a 1 megohm 1/4 watt resistor between the analog input (pin S of the rear connector) and signal low (pin R of the rear connector). Adjust R40 on the Analog I Board for a plus and minus indication. Remove the 1 megohm resistor.

Step 6:

Connect a Digital Voltmeter between pins 2 and 3 of integrated circuit A21 with the DVM low lead connected to pin 2. Adjust R81 on the Analog I Board for 0 volts ±300 microvolts as read on the DVM.

CALIBRATION ADJUSTMENTS

Step 1:

With the input shorted, adjust the front panel zero control R59 for a plus and minus indication. Remove the short.

Step 2:

Apply a suitable voltage or current that is equal to 10 digits (pin S signal hi and pin R signal lo). Adjust R83 for a readout of 10 digits. Reverse the polarity of the sig-

nal, the readout should be minus 10 digits.

Step 3:

Apply a suitable voltage or current that is equal to full scale positive. Adjust full scale potentiometer R31 for a readout of 10000.

Step 4:

Reverse the polarity of the voltage or current applied in step 3 and adjust R79 on the Analog I Board for a readout of -10000.

TABLE 1

MEASURED VOLTAGE	RESISTOR R153
0.3mv to 0.6mv	10.0 megohm ¼ watt 5%
0.6mv to 0.8mv	7.5 megohm ¼ watt 5%
0.8mv to 1.1mv	5.6 megohm ¼ watt 5%
1.1mv to 1.3mv	4.7 megohm ¼ watt 5%
1.3mv to 1.6mv	3.9 megohm ¼ watt 5%
1.6mv to 1.9mv	3.0 megohm ¼ watt 5%
1.9mv to 2.2mv	2.7 megohm ¼ watt 5%
2.2mv to 2.6mv	2.2 megohm ¼ watt 5%
2.6mv to 2.9mv	2.0 megohm ¼ watt 5%
2.9mv to 3.3mv	1.8 megohm ¼ watt 5%
3.3mv to 3.8mv	1.5 megohm ¼ watt 5%

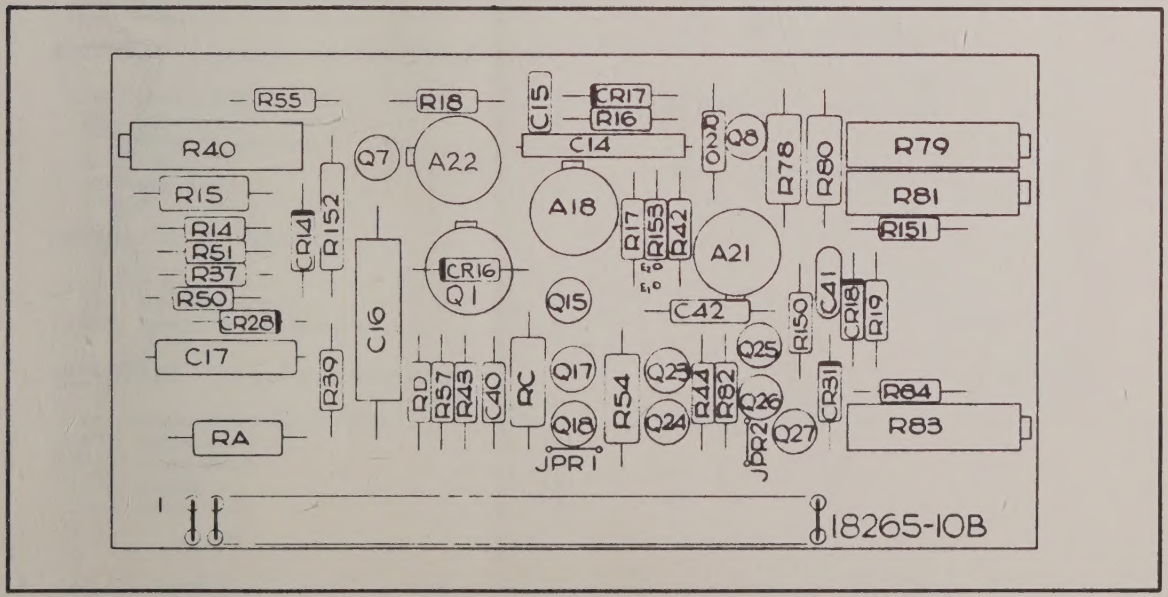


Figure 4-5 (Revised) ANALOG I ASSEMBLY DRAWING

CONTENTS

Page

SECTION I GENERAL INFORMATION

1-1 Introduction 1
1-2 Electrical Specifications 1
1-3 Mechanical Specifications 1

SECTION II INSPECTION AND INSTALLATION

2-1 Introduction 4
2-2 Unpacking and Inspection 4
2-3 Power Requirements 4
2-4 Installation 4
2-5 Reshipment 4

SECTION III OPERATION

3-1 Introduction 6
3-2 Operating Instructions 6
3-3 Remote Mode of Operation 7

SECTION IV THEORY OF OPERATION

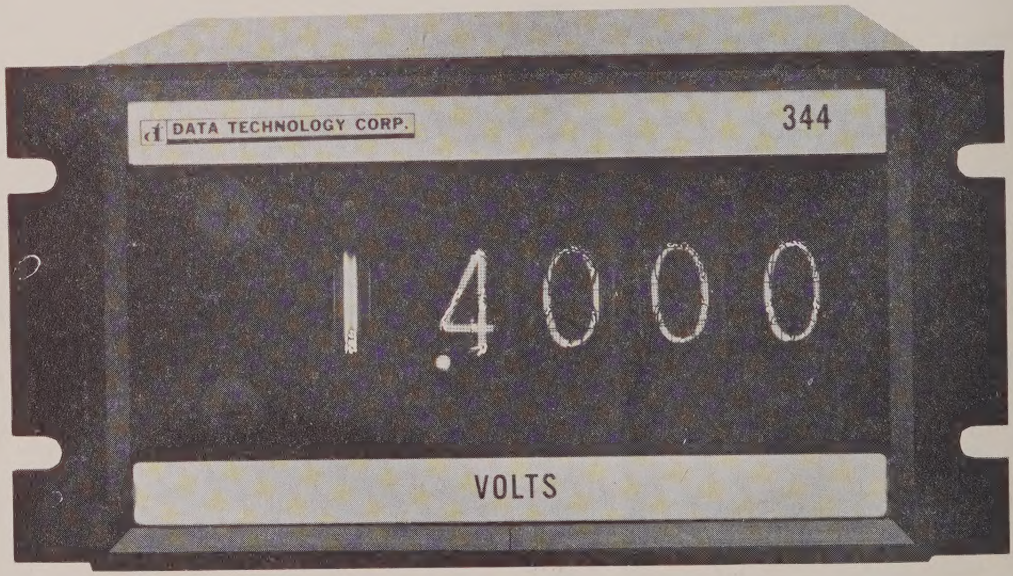
4-1 Analog-to-Digital Conversion 9
4-2 Mother Board 10
4-3 Digital Board 13
4-4 Analog I 13
4-5 Analog II 13

SECTION V MAINTENANCE

5-1 Introduction 18
5-2 Test Equipment 18
5-3 Performance Test 18
5-4 Calibration Procedure 18
5-5 Troubleshooting Technique 19

SECTION VI PARTS LIST

6-1 Introduction 23
6-2 Ordering Information 23



Frontispiece

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

The Model 344 Digital Panel Meter is an accurate, four-digit instrument suitable for industrial system applications. The Model 344 is a dual polarity meter with five DC volts and six DC current versions. The meter also has BCD output signals (DC isolated from the input circuitry) and remote command for system applications.

The instrument has a 40% overranging capability on both DC volts and DC current functions. When the 40% overrange limit has been exceeded, the overrange "1" neon pulsates, and the unit locks up at 14,000 count.

The measuring technique used in the Model 344 is the dual slope integration method. This technique provides very good noise rejection capabilities, excellent accuracy, and good long-term stability of the instrument. All silicon solid state devices, with maximum usage of integrated circuits give the 344 outstanding performance and reliability in a compact package.

1-2. ELECTRICAL SPECIFICATION

Table 1-1 lists the electrical specifications for the Model 344 Digital Panel Meter.

1-3. MECHANICAL SPECIFICATIONS

The dimensions of the instrument are 2-1/2" height x 5" width x 7-1/2" depth. Figure 1-1 is an outline drawing of the Model 344 showing these dimensions. The mounting flanges accomodate #6 mounting hardware on 4,700" x 1,400" centers (Figure 1-1). Weight of the instrument is approximately 30 ounces.

TABLE 1-1

ELECTRICAL SPECIFICATIONS

FIVE FACTORY SET VOLTAGE RANGES (FULL SCALE)

0 - 100.00 millivolts	344-1
0 - 1.0000 volts	344-2
0 - 10.000 volts	344-3
0 - 100.00 volts	344-4
0 - 999.9 volts	344-5

SEVEN CURRENT RANGES (FULL SCALE)

0 - 10.000 microamps	344-6
0 - 100.00 microamps	344-7
0 - 1.0000 milliamps	344-8
0 - 10.000 milliamps	344-9
0 - 100.00 milliamps	344-10

ACCURACY

Range	Accuracy
100mV	± (.01% Rdg + .05% FS)
1, 10, 100V	± (.01% Rdg + .01% FS)
1000V	± (.05% Rdg + .01% FS)
DC Current	± (.01% Rdg + .03% FS)

Overrange: 40% all ranges and functions at rated accuracy (with exception of 1000V range).

Temperature Coefficient:
1, 10, 100, & 1000V Range: ± (.002% Rdg + .001% FS)/C°

100 mV & DC Currents: ± (.002% Rdg + 0.005% FS)/C°

MAXIMUM VOLTAGES

Range	
100 millivolts	100V
1 volt	250V
10 volt	1000V
100 volt	1000V
1000 volt	1000V

INPUT SAMPLE TIME

33.3 millisecond (Faster versions available)

READING RATE

5 Readings/Second (Faster versions available)

OUTPUT CHARACTERISTICS

Visual: Display Storage includes four digital readout indicators with one overrange digit, decimal point, and polarity indicators.

Overrange Indication: Flashing overrange indication when the input has exceeded the full-scale value of the selected range.

Polarity Indication: (+) (–) illuminated automatic polarity indication.

ELECTRICAL: DIGITAL OUTPUTS AND REMOTE CONTROL

Outputs & Controls	Characteristics
BCD 1248	T^2L Micrologic
4 Decades	
Logic "1"	$>$ 2.4 V
Logic "0"	$<$ 0.4 V Sink for 4 ma
Overrange	$>$ 2.4 V
Polarity	(+) 2.4 V (−) 0.4 V Sink $<$ 4 mA
Remote Control Signal	0 to +5 V Level Max. width 200 ms
Print Command	Positive pulse
(on request)	10 μs wide $>$ 2.4 V

INPUT POWER

115V ± 10%, 50 to 60 Hz
Approximately 10 watts
115 VAC Model may be quickly modified to 230 VAC Unit

ENVIRONMENT

Temperature Operating: 0 to 50°C
Temperature Storage: −40° to 75°C

SECTION II INSPECTION AND INSTALLATION

2-1. INTRODUCTION

This section outlines procedures for inspection and initial installation. Reshipment instructions are included in case the instrument must be returned.

2-2. UNPACKING AND INSPECTION

Before accepting the instrument from the shipper, inspect the crated instrument for external damage. Any sign of external damage must be noted by both customer and shipper and should be called to the attention of an insurance investigator.

As soon as the equipment is unpacked inspect the instrument for damage in shipment. Check for scratches or dents and damaged switches or connectors. If damage is noted, do not use the instrument unless instructed by the insuring agency.

2-3. POWER REQUIREMENT

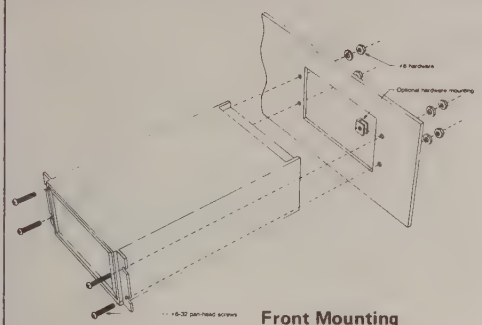
The Model 344 Digital Panel Meter is designed to operate from either 115 VAC ± 10% 50-60 Hz or 230 VAC ± 10%, 50-60 Hz power source. The unit dissipates approximately 10 watts. CAUTION: Do not connect this instrument to a power source with incorrect voltage or inadequate current.

2-4. INSTALLATION

For rack mounting procedure, refer to Figure 2-1.

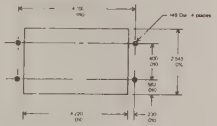
2-5. RESHIPMENT

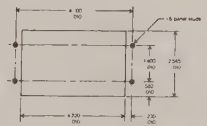
When a damaged instrument is to be returned to the factory for repair or service, contact your nearest Data Technology Corporation representative for written permission to ship, for shipping instructions, and for a shipping form. Such action will ensure expedient repair and return of the instrument.



Front Mounting

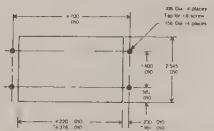
Rear View (rear mounting)

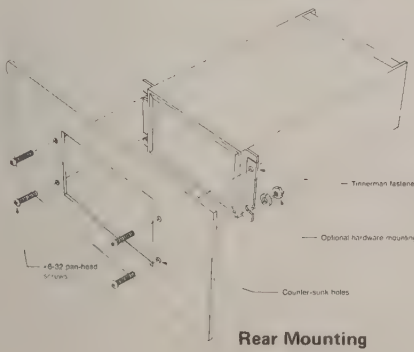




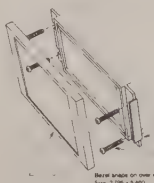
* If Speed Nuts Desired

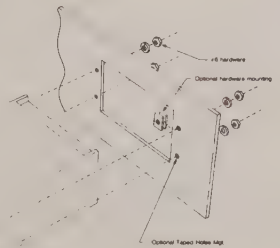
Panel Thickness	Part No (Tinnerman)
1/8	C1925-632
3/16	
1/4	C6736-632





Rear Mounting





Front Mounting with Bezel Accessory

Figure 2-1 Mechanical Installation Options

SECTION III OPERATION

3-1. INTRODUCTION

The following paragraphs and diagrams describe the operating procedure and external control for the Model 344 Digital Panel Meter.

3-2. OPERATING INSTRUCTIONS

The Model 344, unless otherwise specified, is shipped with 1/4 amp fast blow fuse for 115 VAC operation. For 230 VAC operation, a 1/8 fuse must be inserted for the 1/4 fuse.

CAUTION: Before turning on power, be absolutely sure that proper interconnect is made. Figure 3-1 shows the pin configuration assigned for the Model 344.

1. Insert the AC power cord to the AC line. Since the 344 does not have a power switch, the unit will be automatically turned on. The display tube should light immediately.

2. There are three input terminals on the Model 344. They are Input High, Low, and Guard. Both Input High and Low are used for all functions. The Guard terminal of the instrument functions as a shield between the floating analog circuitry and the logic power line ground. The proper use of the guard provides high rejection of both AC and DC common mode voltages. Two points listed below are for the optimum hook-up.

3. Guard potential must be as near as possible to Low. (Do not exceed 200V between Guard and Low.)

4. The Guard current must not flow in the circuit impedance being measured.

5. Short the signal input hi and lo. The readout should be 0000 or 0001. (If not, zero procedure is explained in Section V).

6. Apply full-scale voltage or current (10,000) across the signal input hi and lo. The display should indicate its value and polarity.

7. Reverse the input signal and verify the polarity reverses and amplitude is approximately unchanged.

8. Remove the input and disconnect the power.

3-3. REMOTE MODE OF OPERATION

The Model 344 is capable of remote operation with external start and print command.

The BCD outputs are capable of sinking 4mA of current when using compatible TTL or DTL Logic. The logical "1" output voltage is 2.4V minimum and logical "0" output is 0.4V minimum when sinking 4mA.

Start Command: To externally command the start of a measurement time, the start level must be positive going from 0 to 2.4V minimum and back to 0V after print command pulse has been executed. (Note: a special unit with pulse trigger is available.)

Print Command: This positive going pulse occurs at the end of the measurement time. At this time, the updated information is transferred from the counter to the storage element (quad latches). The new BCD information is ready for external usage at Print Command Time.

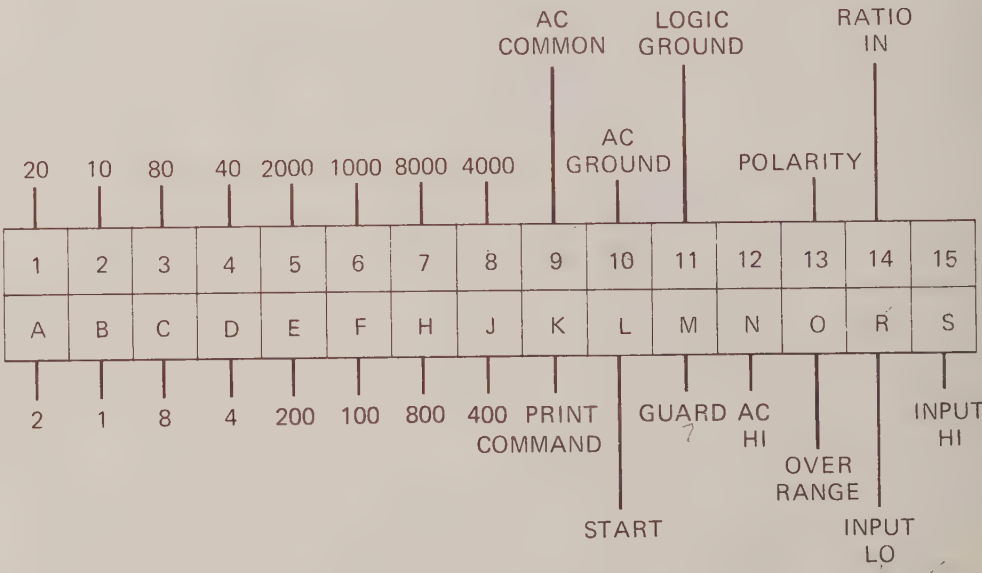

AC COMMON
LOGIC GROUND
RATIO IN
AC GROUND
POLARITY
20 10 80 40 2000 1000 8000 4000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A B C D E F H J K L M N O R S
2 1 8 4 200 100 800 400 PRINT COMMAND
START
GUARD
AC HI
OVER RANGE
INPUT LO
INPUT HI

Figure 3-1 Rear View

SECTION IV THEORY OF OPERATION

The Data Technology Model 344 four-digit panel meter is constructed utilizing the mother board concept with three plug-in printed circuit boards. These three boards are Analog No. I, Analog No. II, and Digital Board. (See the schematic diagram included as a foldout at the back of the manual.)

4-1. ANALOG-TO-DIGITAL CONVERSION

The analog-to-digital conversion is accomplished by the dual slope integration technique. Two printed circuit cards are required to perform this function: one A/D Converter (A4) and the counter logic board (A1). (Refer to Figure 4-1.) The dual slope integration process is first initiated by the reset oscillator. The reset oscillator's pulse (2 μs typical) resets the counter and J-K flip-flop to a zero state. Also at the same time, the start-full scale F/F is set. The zero detect F/F, which is set by the start-full scale F/F, enables the astable multivibrator start. The input F/F is also set via T1. It should be noted here that the input F/F acts as a buffer isolation from the start-full scale F/F (through the pulse transformer T1). At t_o, the input F/F turns on SW1 and SW2, allowing the current from the input amplifier darlington to discharge the integrating capacitor. For the negative input voltage, the current flows through Rx and Rgm via PNP transistor darlington of the input amplifier. The voltage drop across Rx is equal to the potential across Rx; thus the identical current flows through each resistor. Unidirectional current from the integrating capacitor is obtained regardless of the input voltage polarity. This process continues until 10,000 pulses are counted (full scale).

At full scale time T_{fs}, the start-full scale F/F is reset by the 10,000 count from the counter. The frequency of the clock oscillator is 200 kHz, thus making t_o to t_{fs} 50 ms (for 5 μsec. clock period). On the isolated analog side, the input F/F is reset (at t_{fs}) through T1. The input F/F causes both SW1 and SW2 to open (A4-Q13, A4-Q14 are both turned off, respectively). To stop the discharge of the integrating capacitor, transistor A4-Q13 is turned off and diode A4-CR9 becomes reversed bias. At the same time, SW2 is opened and I_{REF} is allowed to recharge the integrating capacitor back to +15 volts. Zero detect (ZD) occurs when the integrating capacitor is charged slightly greater than 15V (normally less than 600 μV, which is equal to one digit). The ZD pulse is transmitted through T2 and resets the ZD F/F. While the ZD F/F is disenabling the clock, a one shot pulse enables the quad-latch to accept the new BCD information into storage. The decode-driver receives this information from the quad latch and then drives the neon-gas filled tube. This then completes one cycle

of operation.

To summarize, the dual slope technique performs analog-to-digital conversion by first integrating an input signal for 50 ms, thereby establishing a voltage on an integrating capacitor (A4-C9) proportional to the input signal. The capacitor is then charged back to its initial condition at the constant rate. The time taken to charge the capacitor back to initial condition is also proportional to the input signal. The important waveforms are shown in Figure 4-2. The time taken to integrate at rates proportional to the input voltage is called t_1 (or t_o-t_{fs} time). The time taken to charge the integrated capacitor back to zero is called t_2. A clock in the logic section allows integration of the input voltage 10,000 count. A counter in the logic section performs the necessary counting. When 10,000 count has been reached, the input current (I_{IN}) passed to the A/D converter is switched off, and a reference current generator is switched into the integrating capacitor. This reference current charges the capacitor at a constant rate. The counter in the logic section continues to run until the capacitor has reached the start voltage. The counting is then terminated, and the number of counts, N, is proportional to the amplitude of the input voltage. The clock rate, amplifier gain, and amplitude of the reference current are chosen in such a way that the counter number can be displayed directly in volts.

4-2. MOTHER BOARD

The Mother Board serves three useful purposes. First, the Mother Board supplies various voltages to power the unit. Secondly, the Mother Board serves as an interconnect for the other three plug-in boards. Third, the Mother Board is for decode and display.

There are four different power supplies used in the Model 344. They are +210V, +5V, +28V, and −12V DC.

The digital readout portion of the Mother Board contains four neon filled gas tubes, overrange "1" neon, and two other neons (polarity) for visual display. Each tube has a self contained decimal point for the convenience of the user. The binary coded decimal information is transferred into the decoder drive elements, A1 through A4, which in turn determines the visual readout. The Mother Board assembly drawing is included as Figure 4-3.

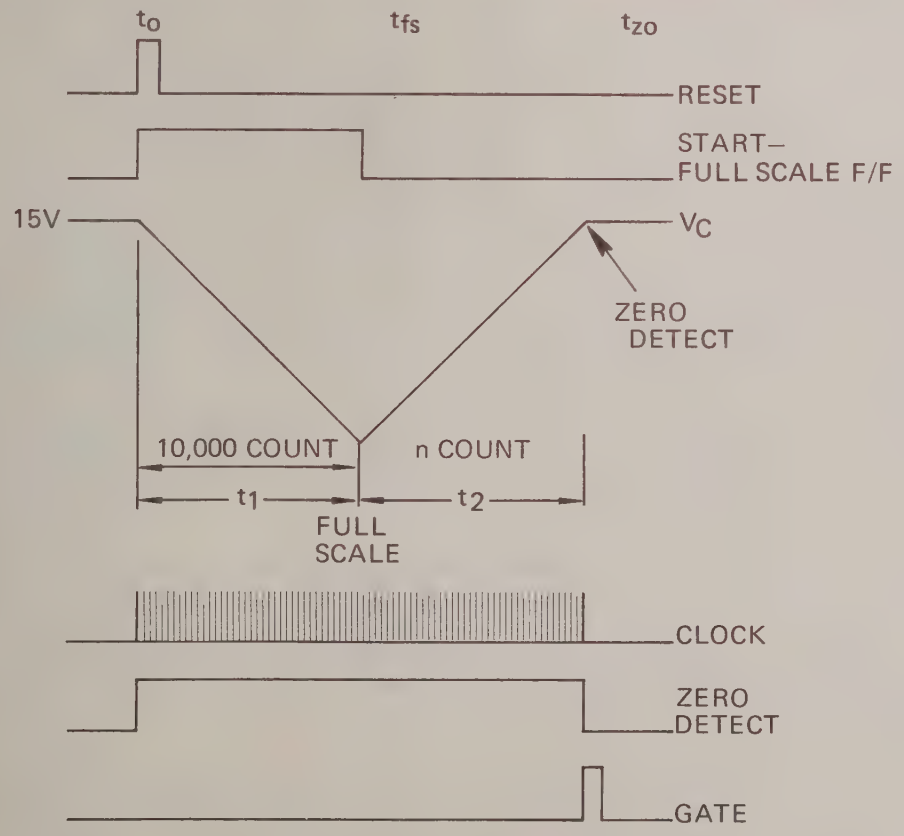


Figure 4-2 Dual Slope Waveforms

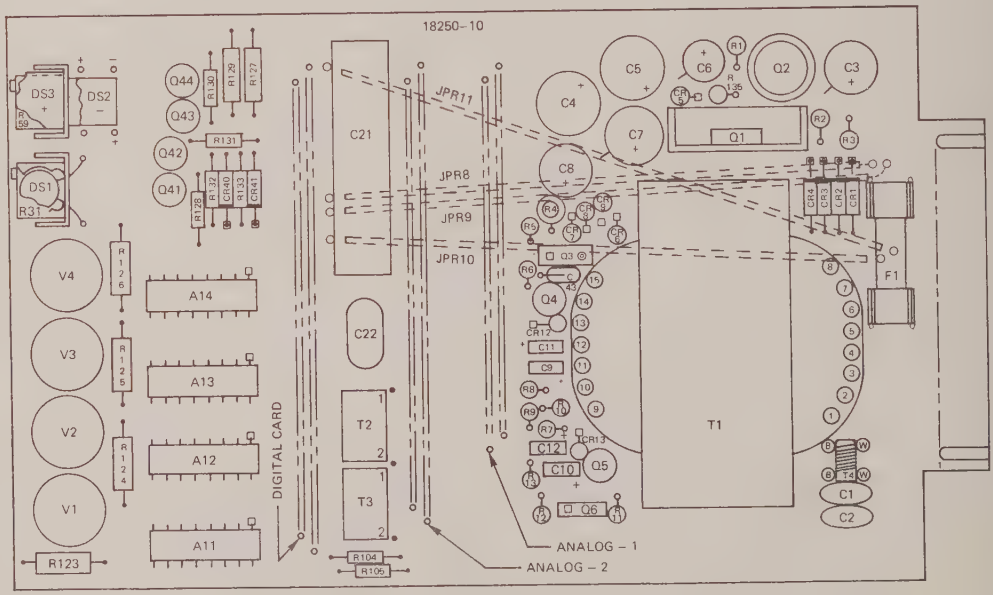


Figure 4-3 Mother Board Assembly Drawing

4-3. DIGITAL BOARD

The Digital Board can be divided into two basic areas. First, the logic section which consists primarily of DTL gates and discrete monostable and astable multivibrator. The basic operation of the logic has been discussed in Paragraph 4-1; therefore, further detail is not necessary. All buffer stored digital data output is fed directly from the A1 card to the pin connector of the Model 344. Also, the hold, start, and print command functions are executed on this card. The positive going start level must be +5 volts for a minimum of 300 ms. At the end of the measurement time, the print command (or gate pulse) pulse occurs.

This pulse is approximately 5 μs wide and 4 volts in amplitude. Both counter (A1, A2, A3 and A4) and quad latch (A5 through A9) are TTL integrated circuits. The Digital Board assembly drawing is included as Figure 4-4.

4-4. ANALOG I

The Analog I Board has two basic circuits. They are the input amplifier and the negative current amplifier. An assembly drawing is shown as Figure 4-5.

Input Amplifier: The input amplifier has an input stage utilizing a μA727 (A1) which is followed by a μA741 operational amplifier. The μA727 consists of a two-stage differential-input, differential-output amplifier, plus a temperature regulator. This combination serves as a transconduction amplifier (voltage to current transfer) in which R13 is the transconductive resistor. With positive input voltage, the current flows through the darlington NPN's (Q5 and Q6) from the integrating capacitor. For negative input voltage, the path of the current is via R26, Q7 and Q8 (PNP darlington).

The bootstrap amplifier (Q1 and Q3), with the PNP (Q2) current source, allows compensation of input current of the μA727 without sacrificing input impedance of the Model 344.

Negative Current Amplifier: This amplifier (A3) provides unidirectional current for the integrating capacitor as already discussed in Section 4-2. Potentiometer R29 allows negative zero adjustment and potentiometer R27 provides negative full-scale adjustment.

4-5. ANALOG II

The three circuits on the Analog II Board are the reference amplifier, zero detect circuit and the ratio option. An assembly drawing is shown as Figure 4-6.

Reference Amplifier: This amplifier (A4) serves as a transconductance amplifier by taking the reference voltage of CR13 and converting it into a

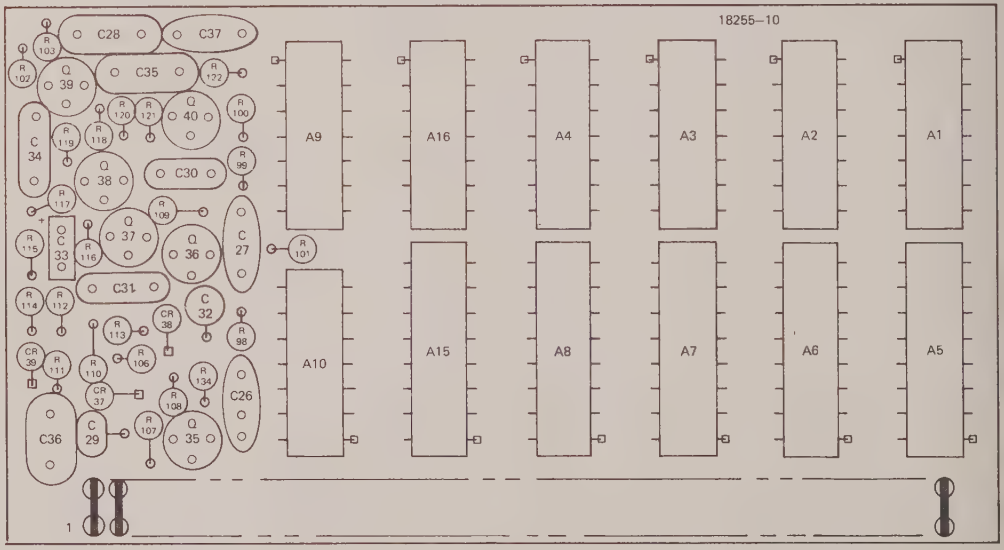


Figure 4-4 Digital Board Assembly Drawing

very accurate current at the output of the collectors Q15 and Q16. This current then recharges the integrating capacitor during t_{fs} to t_{zd} time.

Zero Detect Circuit: This FET input amplifier (Q21 through Q26) serves as a very sensitive switch when the integrating capacitor, C9, becomes recharged (to slightly positive potential). When the switching action occurs, a pulse is coupled through the transformer A1-T1 to stop the counter.

Ratio Option: The ratio option converts the input reference voltage into an accurately known current which is then processed by the referenced amplifier.

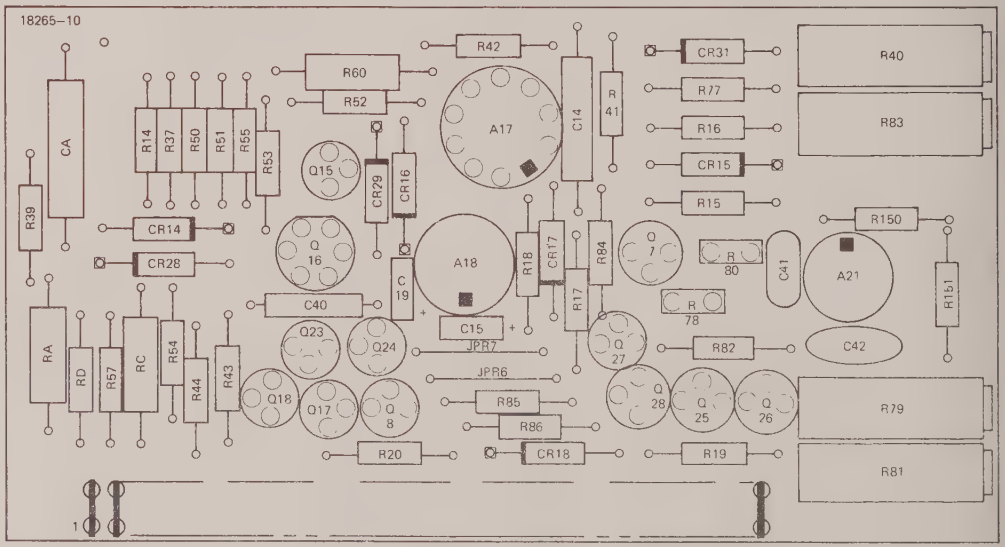


Figure 4-5 Analog I Assembly Drawing

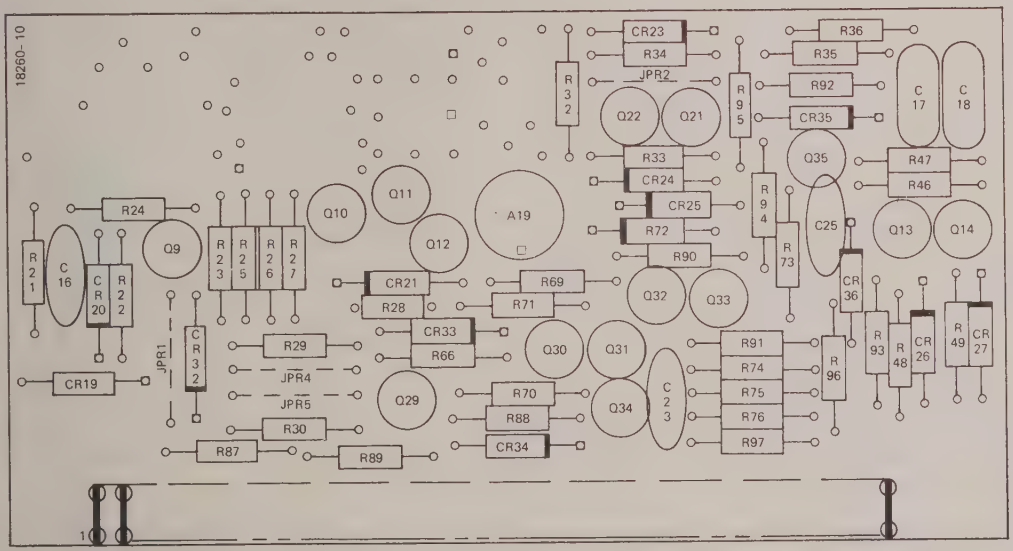


Figure 4-6 Analog II Assembly Drawing

SECTION V MAINTENANCE

5-1. INTRODUCTION

This section contains the necessary information for calibration, performance check, and trouble shooting of the Model 344 Panel Meter. Also included is a list of test equipment necessary for the above test.

5-2. TEST EQUIPMENT

The test equipment required for calibration performance test and trouble shooting is listed in Table 5-1.

5-3. PERFORMANCE TEST

The performance test to verify the electrical specifications is described in Table 5-2. Performance testing should be done at 90 day calibration intervals and after repair.

DC Accuracy: Proceed as follows to check the DC voltage accuracy of the Model 344.

1. Connect the rear connector and apply AC line voltage. (CAUTION: Damage will result if proper pins are not connected. Refer to Figure 3-1 for pin list.)

2. Connect High and Low (with Low to Guard) of the instrument to the DC voltage calibrator.

3. Follow the procedure as described in Table 5-2 for DC voltage accuracy check.

4. Reduce voltage calibrator output to zero volts; remove AC line power and disconnect test equipment.

5-4. CALIBRATION PROCEDURE

1. Allow 15 minutes warm up time before start of calibration.

2. With input shorted, adjust zero amplifier for zero crossing polarity lights toggle (R59).

3. Apply 10 digit positive, adjust negative zero (R81) for minimum number of counts (adjust until there is no effect on positive).

4. With 10 digit positive adjust zero compensation (R83) to read 10 digits.

5. Reverse input voltage polarity (to negative) and adjust negative zero (R81) to read – 10 digits.

6. With 13000 digits positive input, adjust positive full scale pot R31 for 13000 digits.

7. With 13000 digits negative, adjust (R79) for negative full scale to 13000 digits. This concludes calibration procedure.

5-5. TROUBLESHOOTING TECHNIQUE

Table 5-3 which is shown below gives a brief but helpful troubleshooting guide for the Model 344.

TABLE 5-1
REQUIRED TEST EQUIPMENT

Instrument	Purpose	Recommended Instrument
DC Voltage Calibrator	DC Voltage Calibration & Test Accuracy: ± 0.003% Range: 1 μV to 1100V	Fluke Model 322B or Equivalent
Oscilloscope	General Troubleshooting Equipment	Tektronic Type 547 with 1A7 Plug-in or Equivalent
Digital Voltmeter	Troubleshooting Accuracy: ± 1 μV to 1100V	Data Technology Model 350

TABLE 5-2

VERIFICATION OF ELECTRICAL SPECIFICATIONS

DC STANDARD	READOUT ERROR
± 0.0000	± 1 digit
± 0.1000	± 1 digit
± 0.3000	± 1.3 digit
± 0.5000	± 1.5 digit
± 0.7000	± 1.7 digit
± 1.0000	± 2.0 digit
± 1.3000	± 2.3 digit

Note: This table assumes a basic 1 volt panel meter. Consult specifications in Section I for other voltage and current ranges.

TABLE 5-3

COMMON PROBLEM AREAS AND THEIR POSSIBLE CAUSES

SYMPTOM OF MALFUNCTION	POSSIBLE PROBLEM AREA	POSSIBLE CAUSE
Nixie Tubes Do Not Light Up.	+210 VDC	Check Fuse, AC Line Voltage, at Proper Transformer Tap, MB-CR1, MB-CR2.
All Digits Light Continuously	+5 VDC	Check on Mother Board Q1, Q2, CR3, CR4, CR5
Unit Inoperative	A/D Conversion Not Taking Place	Refer to Section IV (Theory of Operation) Check the following: 1) Reset Oscillator 2) Start – Full Scale F/F 3) Clock Oscillator 4) Counter 5) Input F/F 6) Analogy Switches (diode current switching) 7) Input Amplifier
Responds Only to Positive Inputs	Negative Amplifier	Check on Analog I Board the Following: A21, Q25, Q26
Responds Only to Negative Input	NPN Darlington Circuit in the Input Amplifier	Check on Analog I Board Q17, Q18.

SECTION VI PARTS LIST

6-1. INTRODUCTION

The purpose of this section is to list the components used in the Model 344 for ordering replacement parts. Table 6-1 lists the parts in printed circuit card grouping with reference designator description and Data Technology part number.

6-2. ORDERING INFORMATION

When ordering replacement parts, address the order directly to Data Technology Corporation, 1050 East Meadow Circle, Palo Alto, California 94303.

Identify part by circuit reference designation, assembly number, or Data Technology part number. Also include model and serial number of the instrument.

TABLE 6-1

PARTS LIST

Part No.	Description	Quantity
18250-10	Printed Circuit Board Assembly (Mother Board 4-digit panel meter)	1
18265-10	Printed Circuit Board Assembly (Analog No. 1)	1
18260-10	Printed Circuit Board Assembly (Analog No. 2)	1
18255-10	Printed Circuit Board Assembly (Digital)	1
15770-01	Film, Polaroid	1
15540-01	Housing	2
15776-03	Tag, Serial (Part No.)	1
19495-06	Strip, Identification, Upper (344)	1
17374-14	Screw, Moeline, PH (Slot 6-32 x 4 2G CD PL)	2
17401-05	Nut, Hex, Keps (6-32 stainless steel)	2
16329-01	Pin (19-gauge wire)	2
17238-01	Wire Jumper, JPR1 (22-gauge solid)	1
19495-12	Strip, Identification, Lower (Volts DC)	1

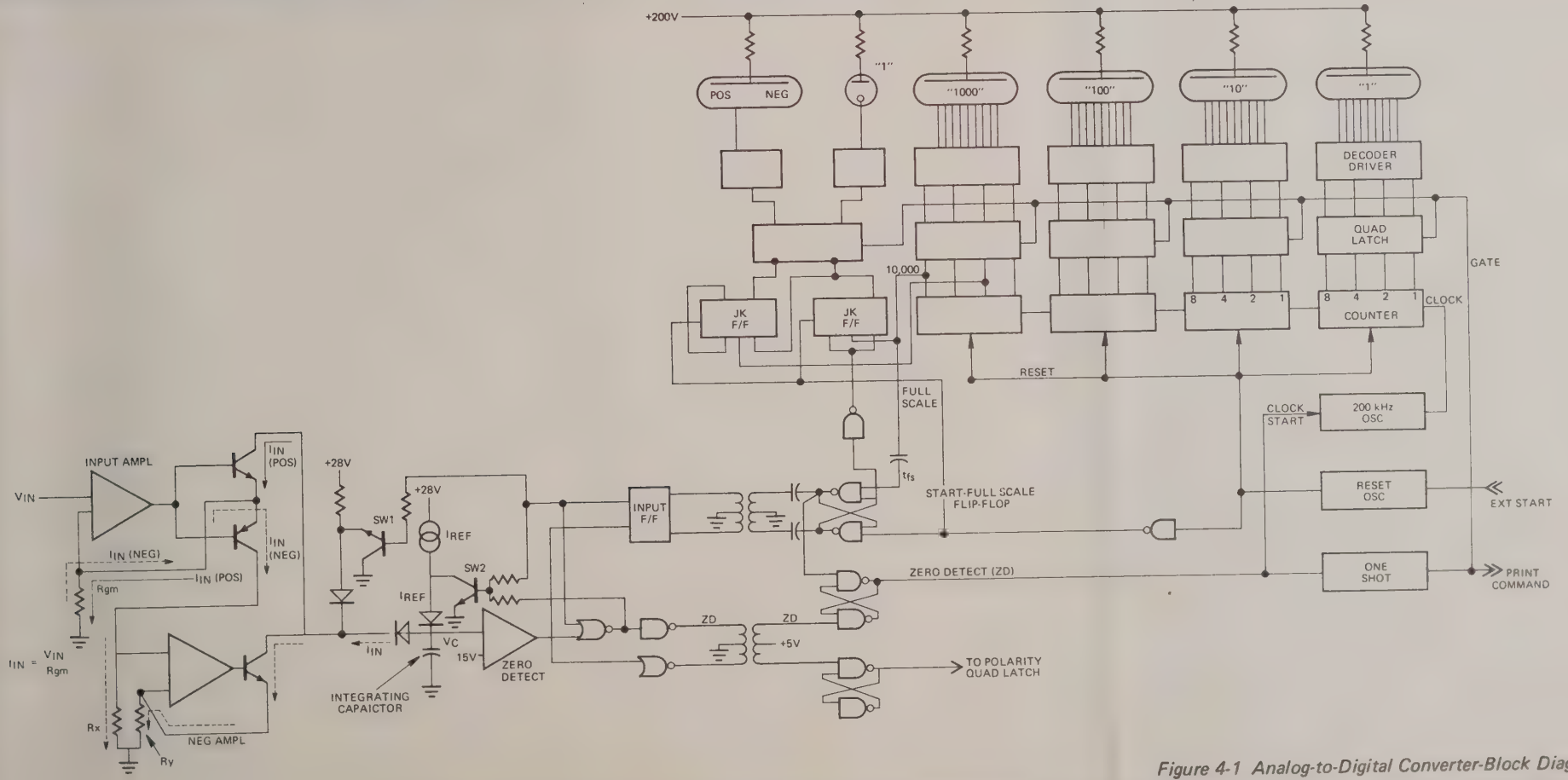
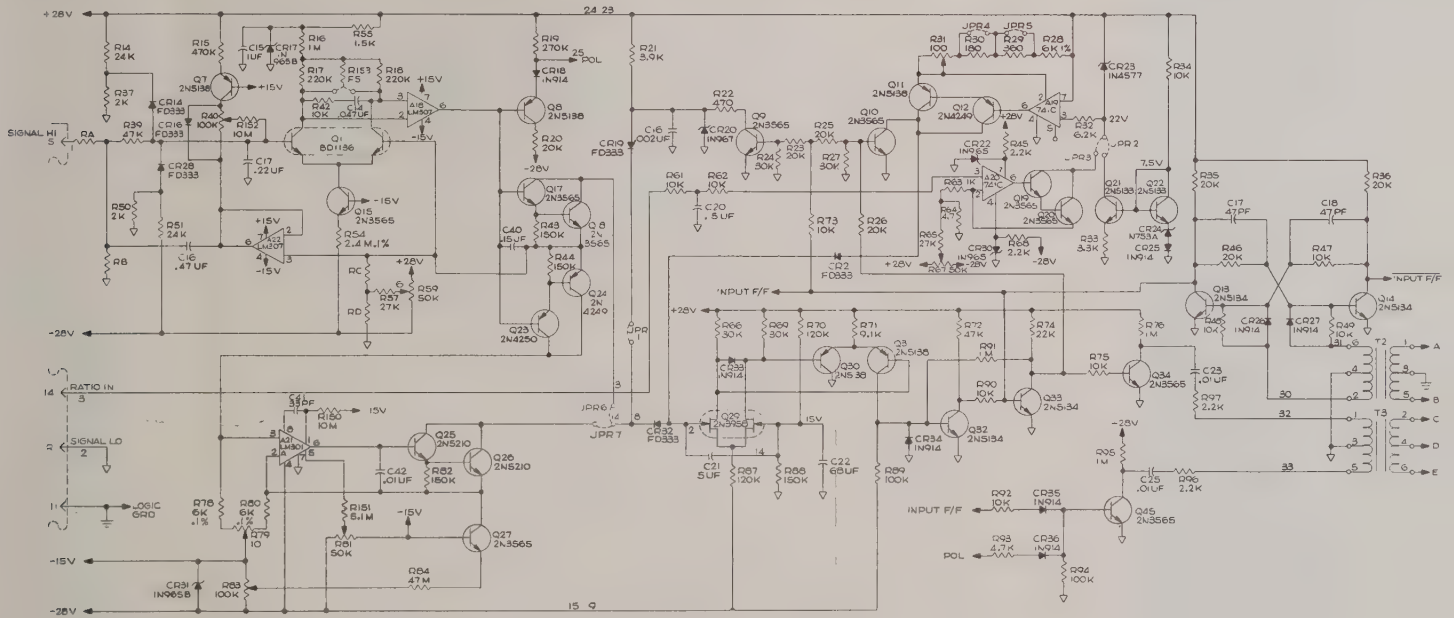


Figure 4-1 Analog-to-Digital Converter-Block Diagram

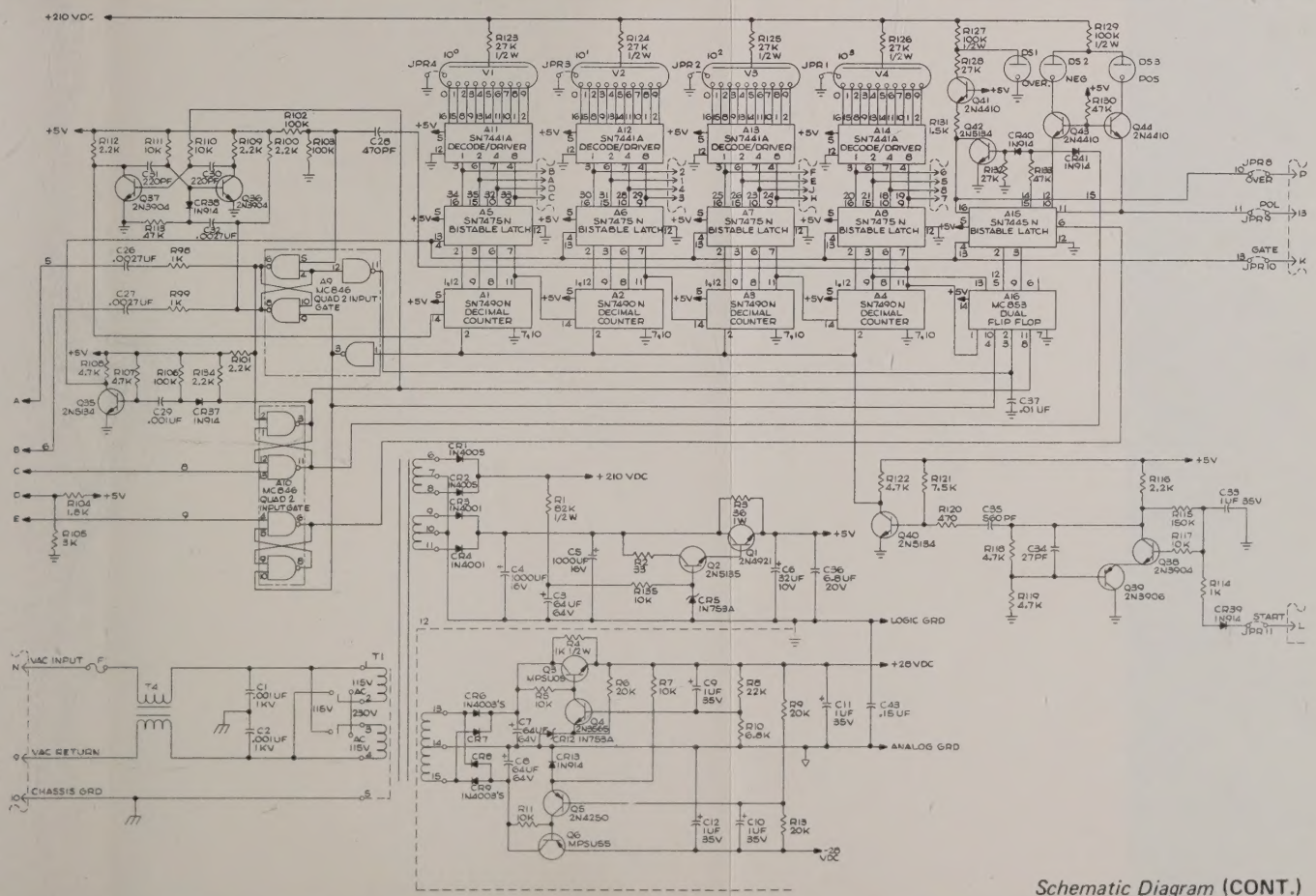


R&C VARIATION CHART							
MODEL NO.	DASH NO.	RANGE	RA	RB	RC	CA	RD
344	-10	00.000 MV	47 Ω, 1/2 W, 5%	——	.00 Ω, 1%	.33 UF, 100V, 5%	2.70 2%
344-2	-11	1.0000 V	100K, 1/4 W, 5%	——	1K, 1%	.15 UF, 100V, 5%	10.0 2%
344-3	-12	10.000 V	M .1%	11K, 1%	11K, 1%	.15 UF, 100V, 5%	10.0 2%
344-4	-13	100.00 V	M .1%	0.1K, 1%	1K, 1%	——	10.0 2%
344-5	-14	1000.0 V	M .1%	11K, 1%	1K, 1%	——	10.0 2%
344-6	-15	10.000 MA	JUMPER	10K, 1%	10Ω, 1%	——	10Ω 2%
344-7	-16	100.00 MA	JUMPER	1K, 1%	10Ω, 1%	——	10Ω 2%
344-8	-17	1000.0 MA	JUMPER	10Ω, 1%	10Ω, 1%	——	0Ω 2%
344-9	-18	10.000 MA	JUMPED	0 Ω, 1%	10Ω, 1%	——	10Ω 2%
344-10	-19	100.00 MA	JUMPER	Ω, 1%	10Ω, 1%	——	10Ω 2%

1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5%
NOTES: UNLESS OTHERWISE SPECIFIED

LAST NUMBER USED: C43
CR41
Q45
R153

Schematic Diagram for Model 344 Panel Meter



Schematic Diagram **(CONT.)**

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1005322

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